BIPN100  Human Physiology 1  Bill Kristan, Ph.D.

Dr K’s office hours:

<table>
<thead>
<tr>
<th>In office</th>
<th>Tuesdays</th>
<th>2:30-3:30 PM</th>
<th>3122A Pacific Hall (not on Tues, Oct 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Fridays</td>
<td>11 AM to noon</td>
<td>3502 Pacific Hall</td>
</tr>
</tbody>
</table>

Midterm events:

<table>
<thead>
<tr>
<th>Wed Oct 21</th>
<th>Review for Midterm 1</th>
<th>5:30-7:30 PM: Dr. K in 3500 Pacific Hall, IAs in 3501 &amp; 3502 PH (doors locked at 6:00 PM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thurs Oct 22</td>
<td>Last-minute Review</td>
<td>In class</td>
</tr>
<tr>
<td>Thurs Oct 22</td>
<td>Midterm exam</td>
<td>7 - 8:20 PM</td>
</tr>
</tbody>
</table>

Places:  Last name A-N:  Galbraith 242
         O-V:  York 2622
         W-Z:  HSS 1330

Midterm exam will cover through Autonomic Nervous System (not Hormones—lecture by Dr. Kathleen French on Tues, Oct 20)

Problems with time or arrangements for the midterm? Tell Dr. K IMMEDIATELY!

TA sections, office hours:

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Section</th>
<th>IA</th>
<th>Office Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fri</td>
<td>11:00-11:50am</td>
<td>SEQUO 148......</td>
<td>Winjet Chou.........</td>
<td>Wed 3-3:50 pm</td>
</tr>
<tr>
<td>Fri</td>
<td>12:00-12:50pm</td>
<td>SEQUO 147....</td>
<td>Saaatchi Patell......</td>
<td>Wed 1-1:40 pm</td>
</tr>
<tr>
<td>Fri</td>
<td>1:00-1:50pm</td>
<td>WLH 2115 .....</td>
<td>Justine Liang ..........</td>
<td>Tues 10-10:50 am</td>
</tr>
<tr>
<td>Fri</td>
<td>2:00-2:50pm</td>
<td>WLH 2206 .....</td>
<td>Hao Shi..................</td>
<td>Fri 3-3:50 pm</td>
</tr>
<tr>
<td>Mon</td>
<td>9:00-9:50am</td>
<td>WLH 2115.......</td>
<td>Tim Macaulay..........</td>
<td>Tues 12:30-1:20 pm</td>
</tr>
<tr>
<td>Mon</td>
<td>4:00-4:50pm</td>
<td>WLH 2208.......</td>
<td>Mallorie Nguyen.......</td>
<td>Thurs 2-2:50 pm</td>
</tr>
<tr>
<td>Mon</td>
<td>5:00-5:50pm</td>
<td>WLH 2208.......</td>
<td>Donel Purcella........</td>
<td>Mon 3-30-4:20 pm</td>
</tr>
<tr>
<td>Mon</td>
<td>6:00-6:50pm</td>
<td>WLH 2115.......</td>
<td>Kyra Rashid............</td>
<td>Thurs 10-10:40 am</td>
</tr>
</tbody>
</table>

Imaging: **correlations** between sensation/behavior and brain activity.

Stimulation (electrical or magnetic): provide **sufficiency** tests.

Silencing (surgical, accidental, chemical): are **necessity** tests.

Anatomy of sensory systems:

Specialized regions of the cerebral cortex: **frontal, parietal, occipital, temporal**.

Most sensory pathways (**not smell**) synapse in **thalamus**

Somatosensation:

  - Touch, muscle stretch: via **dorsal columns**; cross over in brain stem, goes to thalamus via the **medial lemniscus**.
  - Pain, temperature: cross over in spinal cord, via anterolateral tract to thalamus

Regions of the spinal cord: **cervical, thoracic, lumbar, sacral**; innervate **dermatomes**.
Today:

Motor pathways

Autonomic nervous system (ANS)
Motor pathways
Motor cortex and somatosensory cortex
Primary motor cortex of left cerebral hemisphere

Cranial nerves to selected skeletal muscles

Most corticospinal pathways cross to the opposite side of the body at the pyramids.

Somatic motor neurons to skeletal muscles

Lateral corticospinal tract

Anterior corticospinal tract

Pyramids

SPINAL CORD

MIDBRAIN

MEDULLA OBLONGATA

FIGURE 10-10 The somatosensory cortex.

FIGURE 13-12 The corticospinal tract. These interneurons run directly from the motor cortex to their synapses with somatic motor neurons. Most corticospinal neurons cross the midline at the pyramids.

(aka dorsolateral tract; to limb muscles)

(aka ventromedial tract; to trunk muscles)
Pathways from the motor cortex to the spinal cord
Summary: Somatosensory inputs to the motor areas
Summary: Output from the motor cortex

green = pyramidal
blue = extrapyramidal
Summary: Basal ganglia and cerebellum connections
Lecture #7
The brainstem, autonomic nervous system and limbic system
α-adrenergic: binds NorEpi better

β-adrenergic: binds Epi better
### Comparison of the pharmacology of autonomic synapses

<table>
<thead>
<tr>
<th></th>
<th>Preganglionic transmitter</th>
<th>Postganglionic receptors</th>
<th>Postganglionic transmitter</th>
<th>Receptors on target organs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sympathetic branch</td>
<td>Acetylcholine</td>
<td>Nicotinic cholinergic</td>
<td>Norepinephrine (a catecholamine)</td>
<td>Adrenergic (α or β)</td>
</tr>
<tr>
<td>Parasympathetic branch</td>
<td>Acetylcholine</td>
<td>Nicotinic cholinergic</td>
<td>Acetylcholine</td>
<td>Muscarinic cholinergic</td>
</tr>
</tbody>
</table>

![Diagram showing synaptic transmission](image)

**Some useful blockers to know about:**

- **d-tubocurarine** (an active agent in the poison called curare)---blocks primarily nicotinic AChRs
- **α-Bungarotoxin**---blocks ONLY nicotinic AChRs very tightly
- **atropine**---blocks muscarinic AChRs, but not nicotinic AChRs
FIGURE 11-11 Summary of efferent pathways
Comparison of the pharmacology of autonomic synapses

| Preganglionic 
transmitter | Postganglionic 
receptors | Postganglionic 
transmitter | Receptors on 
target organs |
|----------------|---------------|---------------|----------------|
| Sympathetic 
branch | Acetylcholine | Nicotinic 
cholinergic | Norepinephrine 
(a catecholamine) | Adrenergic 
(α or β) |
| Parasympathetic 
branch | Acetylcholine | Nicotinic 
cholinergic | Acetylcholine | Muscarinic 
cholinergic |

Spinal cord --- Ganglion --- Target

Some useful blockers to know about:
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Adrenergic receptor types (respond differently to the same transmitters):
- α₁: mostly responds to NorEpi; Phospholipase C => IP3, DAG, Ca²⁺; muscle contraction, secretion
- α₂: mostly to NorEpi; decrease cAMP; muscle relaxation, decreased secretion
- β₁: equal responses to Epi, NorEpi; increases cAMP; mostly heart and kidney
- β₂: more to NorEpi, but not innervated, so Epi has bigger effect; increases cAMP; smooth muscle relaxation.
- β₃: more to NorEpi; increases cAMP; mostly on adipose tissue

**Alpha blockers and beta blockers**: many types;
used to control blood pressure, GI function, kidney function, etc
hypophysis
pituitary

Temperature control
Water balance
Hypothalamus
Urinary bladder control
Pons

Eating behavior
Secondary respiratory center
Cardiac acceleration and vasoconstriction
Cardiac slowing
Respiratory center
Medulla
Major structures of the limbic system (the “emotional brain”)

- Cingulate gyrus
- Thalamus
- Fornix
- Corpus callosum
- Olfactory bulb
- Olfactory tract
- Amygdala
- Hypothalamus
- Medulla
- Pons
- Spinal cord
- Hippocampus

Brain stem = medulla + pons